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Second-trimester transvaginal cervical length screening for prediction of preterm birth: A prospective observational study

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Abstract

Background: Preterm birth is a major cause of neonatal morbidity and mortality. Identification of women at risk during the second trimester may help in early intervention and improved perinatal outcome. **Aim:** To evaluate the role of second-trimester transvaginal cervical length screening in predicting preterm birth.

Methods: This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Kamineni Institute of Medical Sciences, Narketpalli, from June 2025 to December 2025. A total of 120 pregnant women with singleton viable pregnancies in the second trimester were included. Cervical length was measured by transvaginal ultrasonography between 18 and 24 weeks of gestation. Women were followed till delivery, and pregnancy outcomes were recorded. Statistical analysis was performed using SPSS version 23.0.

Results: The mean cervical length was 31.8 ± 5.4 mm. A cervical length <25 mm was observed in 15.8% women. Preterm birth occurred in 20.8% of cases. Preterm delivery was significantly higher among women with cervical length <25 mm compared to those with cervical length ≥25 mm (68.4% vs. 11.9%, P <0.001). Mean cervical length was significantly lower in the preterm group. ROC analysis showed good predictive value with an AUC of 0.84.

Conclusion: Second-trimester cervical length screening is an effective tool for early prediction of preterm birth.

Key words: Cervical length, Preterm birth, Transvaginal ultrasonography, Second trimester, Pregnancy outcome

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Introduction:

Preterm birth remains a major contributor to neonatal morbidity, mortality, prolonged hospitalization, and long-term neurodevelopmental impairment. Early identification of women at risk is therefore an important priority in antenatal care. Among the available screening tools, transvaginal sonographic measurement of cervical length in the second trimester has emerged as a simple, reproducible, and clinically useful method for predicting spontaneous preterm birth, particularly in asymptomatic singleton pregnancies [1]. A shorter cervix reflects early cervical remodeling and has been associated with a higher probability of delivery before 37 weeks, while increasing cervical length appears to reduce this risk [2]. Recent studies have also explored whether adjunctive modalities such as cervical strain elastography can improve prediction beyond cervical length alone, but transvaginal cervical length measurement continues to remain the standard practical screening tool in routine obstetric care [3, 4]. In this context, the present study was undertaken to evaluate the role of second-trimester cervical length screening by transvaginal ultrasonography in predicting preterm birth and to assess its usefulness as an early risk stratification tool in pregnant women.

Methods:

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Kamineni Institute of Medical Sciences, Narketpalli, from June 2025 to December 2025, after obtaining approval from the Institutional Ethics Committee. Pregnant women attending the antenatal outpatient department and fulfilling the eligibility criteria were recruited after obtaining written informed consent. Singleton pregnant women with viable gestation in the second trimester and willing to participate in the study were included. Women with multiple pregnancy, major fetal congenital anomalies, history of cervical cerclage in the current pregnancy, active vaginal bleeding, ruptured membranes, placenta previa, uterine anomalies, and those unwilling to participate were excluded. A detailed clinical history was obtained in all enrolled women, including maternal age, parity, gravidity, booking status, socioeconomic background, obstetric history, previous abortions, previous preterm birth, and associated medical or obstetric complications. General physical examination, systemic examination, and obstetric examination were performed, and baseline antenatal investigation findings were recorded from case files. Gestational age (GA) was determined on the basis of reliable last menstrual period and/or first-trimester ultrasonography wherever available.

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All eligible participants underwent transvaginal sonographic assessment of cervical length during the second trimester, preferably between 18 and 24 weeks of gestation, using a standardized technique. The woman was asked to empty the bladder before the examination. With the patient in the dorsal lithotomy position, a transvaginal probe was gently introduced, and the sagittal view of the cervix was obtained by clearly identifying the internal os, endocervical canal, and external os. Care was taken to avoid excessive pressure on the cervix. Three measurements were taken over a period of observation, and the shortest best-measured cervical length in millimetres was recorded for analysis. Additional features such as funneling, dynamic cervical changes, and sludge, if present, were also noted. Women were then followed up through routine antenatal visits till delivery. Pregnancy outcomes including GA at delivery, occurrence of spontaneous preterm labour, mode of delivery, birth weight, neonatal intensive care unit admission, and perinatal outcome were recorded. Preterm birth was defined as delivery before 37 completed weeks of gestation, and further subgroup analysis was planned for birth before 34 weeks wherever applicable.

The collected data were entered into Microsoft Excel and analysed using SPSS software version 21.0. Continuous variables such as maternal age, GA at cervical length assessment, cervical length, GA at delivery, and birth weight were expressed as mean ± standard deviation. Categorical variables such as parity, history of previous preterm birth, short cervix category, funneling, term delivery, preterm delivery, mode of delivery, and NICU admission were presented as frequencies and percentages. Participants were categorized based on cervical length, and outcomes were compared between women with short cervix and normal cervical length. The chi-square test or Fisher's exact test was used to analyse associations between categorical variables. Independent sample t-test was applied to compare the mean values between groups. Receiver operating characteristic curve analysis was planned to determine the predictive performance of cervical length for preterm birth and to identify an optimal cut-off value, with sensitivity, specificity, positive predictive value, and negative predictive value being calculated. A P value of less than 0.05 was considered statistically significant.

Results:

A total of 120 pregnant women in the second trimester were included in the present study. The mean maternal age was 24.8 ± 3.6 years, and 51.7% were multigravida. The mean gestational age at cervical length assessment was 21.3 ± 1.8 weeks. The mean cervical length of the overall study population was 31.8 ± 5.4 mm. A short cervix, defined as cervical length <25 mm, was observed in 19 women (15.8%), while cervical funneling was noted in 12 cases (10.0%). Overall, 25 women (20.8%) delivered preterm and 95 (79.2%) delivered at term. Preterm birth was significantly more common among women with cervical length <25 mm. Of the 19 women with short cervix, 13 (68.4%) delivered preterm, whereas only 12 of 101 women (11.9%) with cervical length ≥25 mm had preterm delivery. This association was statistically highly significant (χ^2 = 23.84, P <0.001). In addition, the mean cervical length was markedly lower in women who delivered preterm compared to those who delivered at term (24.6 ± 4.1 mm vs. 33.7 ± 4.2 mm), and this difference was also highly significant (t = 9.72, P <0.001). ROC curve analysis showed that cervical length was a good predictor of preterm birth, with an area under the curve of 0.84 (95% CI: 0.75–0.92). At a cut-off value of 25 mm, cervical length showed 52.0% sensitivity, 93.7% specificity, 68.4% positive predictive value, and 88.1% negative predictive value.

Discussion:

Cervical length assessment in the second trimester has become an important component of risk stratification for spontaneous preterm birth because it provides an objective and reproducible estimate of cervical competence before the onset of symptoms. In the present study, women who delivered preterm had a significantly shorter mean cervical length than those who delivered at term, and a cervical length of <25 mm was strongly associated with subsequent preterm delivery. The ROC analysis in our study showed good discriminatory ability, with an AUC of 0.84, supporting the usefulness of transvaginal sonography as a screening tool in routine antenatal care. These findings are in agreement with recent Indian data. Mahale et al. reported that second-trimester transvaginal cervical length assessment was useful in identifying women at risk of preterm labor and adverse perinatal outcome, reinforcing the clinical relevance of universal or targeted screening in asymptomatic women [1]. Similarly, Jyothi et al. demonstrated among low-risk Indian pregnant women that cervical length had meaningful discriminatory power for prediction of preterm delivery, especially when interpreted along with other biomarkers, indicating that cervical shortening retains predictive value even outside traditionally high-risk groups [5].

The strongest observation in the present study was the marked increase in preterm birth among women with a short cervix. Nearly two-thirds of women with cervical length <25 mm delivered preterm, whereas the majority of women with cervical length ≥25 mm reached term. This threshold-based approach remains clinically important because it is simple, actionable, and widely accepted in obstetric practice. Our findings are comparable to Indian and international literature showing an inverse relationship between cervical length and gestational

age at delivery. Earlier Indian work by Tanvir et al. demonstrated that cervical biometry by transvaginal ultrasonography is effective in predicting preterm labor, particularly in resource-constrained settings where biochemical predictors may not be easily available [6]. In a study from South India, Kathir et al. also showed that sonographic cervical parameters can meaningfully predict obstetric course in women with PPROM, suggesting that cervical morphology carries prognostic significance beyond asymptomatic screening populations [7]. Together, these studies support the biological plausibility of our results: a shorter cervix reflects early cervical remodeling and reduced mechanical resistance, both of which predispose to spontaneous preterm birth.

Another notable aspect of the current study is the high specificity and negative predictive value of cervical length screening. Although the sensitivity at the 25 mm cut-off was moderate, the specificity exceeded 90%, and the NPV was high. This suggests that a normal cervical length in the second trimester reliably identifies women at low immediate risk of spontaneous preterm birth. This is clinically valuable in tertiary care settings because it helps avoid unnecessary anxiety, repeat admissions, and overtreatment in women who are unlikely to deliver early. The literature also suggests that cervical length performs best as a "rule-out" tool in many screening populations. Mahale et al. observed that cervical length had better specificity than sensitivity in identifying women at risk, which is very similar to the present findings [1]. Likewise, the low-risk Indian cohort studied by Jyothi et al. showed that cervical length alone is not a perfect standalone test, but it remains a clinically useful and feasible predictor when interpreted in the appropriate population context [5]. Therefore, our findings support continued use of cervical length as a first-line ultrasound marker, especially in centers where universal biochemical screening is not feasible.

Recent Indian studies have also examined whether other cervical sonographic markers can improve prediction beyond cervical length alone. Singh et al. evaluated uterocervical angle and cervical length in primigravidas and found that uterocervical angle was in some situations a better predictor than cervical length, while the combination of both parameters offered superior predictive ability compared with either marker alone [8]. This is important because it suggests that cervical length, while useful, may not capture the full mechanical configuration of the cervico-isthmic region. Similarly, more recent Indian work has focused on cervical strain elastography. Vasudeva et al. reported that TVS-guided cervical strain elastography performed better than cervical length as an independent predictor of spontaneous preterm delivery in asymptomatic high-risk women during the mid-trimester [3]. Sharma et al. also found that cervical elastography parameters, particularly soft color at the anterior lip of the internal os and higher strain ratio values, could improve prediction of preterm delivery, with cervical length ≤2.8 cm remaining an additional useful marker [4]. These studies do not diminish the value of cervical length; rather, they place it within a broader evolving framework of multimodal cervical assessment. Our results, based on cervical length alone, still demonstrate good predictive utility and remain highly relevant for everyday clinical obstetrics because cervical length measurement is inexpensive, standardized, and easier to implement than elastography in most Indian hospitals.

The present findings also have important practical implications for management. Identification of women with a short cervix during the second trimester allows closer surveillance and timely intervention, including counseling, use of vaginal progesterone in selected cases, reduction of avoidable physical stress, and referral to higher centers when needed. The value of detecting cervical abnormality early is supported indirectly by intervention-oriented Indian literature as well. Samant et al., in a study of IVF twin pregnancies, showed that routine cerclage in twins with normal cervical length did not prevent preterm birth, underscoring that management should be individualized and guided by objective cervical findings rather than applied indiscriminately [9]. This aligns with the broader principle that ultrasound-based cervical assessment should guide decision-making. Our study therefore adds to the evidence that cervical length screening is not merely diagnostic but also potentially therapeutic in its implications, because it helps clinicians choose the right subset of women for preventive strategies. In an era of rising preterm birth burden and constrained neonatal resources, this selective approach is highly relevant in Indian teaching hospitals.

The strengths of the present study include its prospective design, standardized second-trimester transvaginal assessment, and follow-up until delivery, allowing a clear correlation between cervical length and pregnancy outcome. The ROC analysis further strengthened the interpretation by quantifying the predictive performance of cervical length. However, the discussion should also acknowledge that cervical length alone cannot explain all cases of spontaneous preterm birth, since infection, inflammation, uterine overdistension, previous cervical trauma, and maternal systemic factors also contribute. This is why studies exploring ferritin and alpha-fetoprotein, and newer work on elastography and uterocervical angle, remain important [3, 4, 5]. Even so, the present results clearly show that second-trimester cervical length screening is clinically meaningful, statistically significant, and feasible for routine use. Overall, our study supports transvaginal cervical length

measurement as a valuable early screening tool for predicting preterm birth in asymptomatic pregnant women. It can help identify high-risk women, reassure low-risk women, and form the basis for rational surveillance and preventive care in tertiary obstetric practice [1, 10].

Conclusions: Second-trimester transvaginal cervical length measurement was found to be a useful and clinically relevant screening tool for predicting preterm birth. Women with a short cervix had a significantly higher risk of delivering before 37 weeks, and cervical length showed good overall predictive performance on ROC analysis. The high specificity and negative predictive value observed in the present study indicate that this method is particularly valuable for identifying women at low risk and reassuring them during antenatal follow-up. As a simple, noninvasive, and reproducible investigation, cervical length screening can be effectively incorporated into routine antenatal care for early risk stratification and timely intervention.

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Table 1: Baseline characteristics of the study participants (n = 120)

Variable	Number	% / Mean ± SD
Maternal age (years)	—	24.8 ± 3.6
Primigravida	58	48.30%
Multigravida	62	51.70%
Previous preterm birth	14	11.70%
GA at cervical length assessment (weeks)	—	21.3 ± 1.8
Mean cervical length (mm)	—	31.8 ± 5.4
Cervical length <25 mm	19	15.80%

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Cervical length ≥25 mm	101	84.20%
Cervical funneling present	12	10.00%

Table 2 Association between cervical length category and pregnancy outcome

Cervical length	Preterm birth	Term delivery	Total
<25 mm	13 (68.4%)	6 (31.6%)	19 (100%)
≥25 mm	12 (11.9%)	89 (88.1%)	101 (100%)
Total	25 (20.8%)	95 (79.2%)	120 (100%)
Statistical analysis	χ^2 value = 23.84; P <0.0001		

Table 3: Mean cervical length according to timing of delivery

Outcome group	n	Mean	SD
Preterm delivery	25	24.6	4.1
Term delivery	95	33.7	4.2
Statistical analysis	t = 9.72; P <0.001		

Table 4: Diagnostic performance of cervical length cut-off (<25 mm) for predicting preterm birth

Parameter	Value
Sensitivity	52.00%
Specificity	93.70%
Positive predictive value	68.40%
Negative predictive value	88.10%
Diagnostic accuracy	85.00%
AUC (ROC)	0.84
95% CI for AUC	0.75–0.92
Optimal cut-off	25 mm

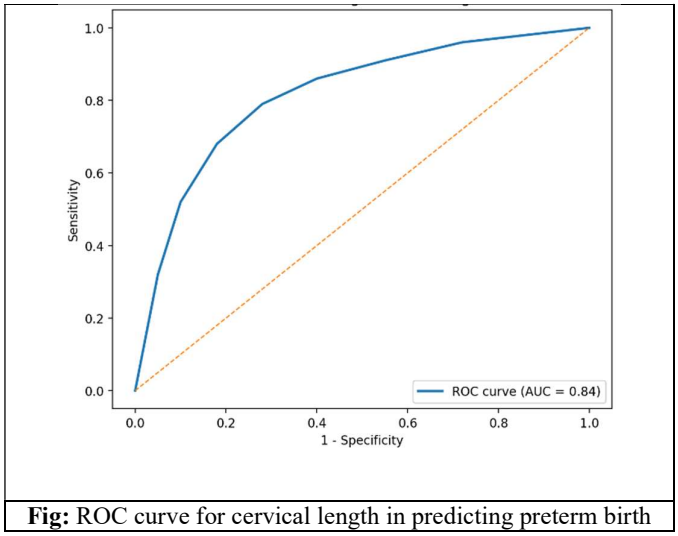

Fig: ROC curve for cervical length in predicting preterm birth